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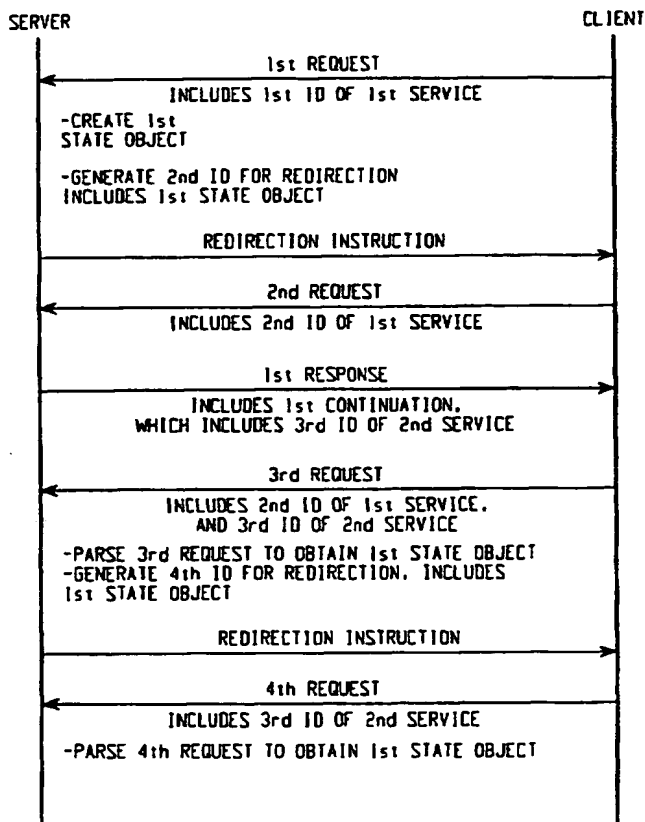
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(54) Title: METHOD FOR STATE PRESERVATION IN HTTP-BASED COMMUNICATIONS



(57) Abstract: This is a method for monitoring client state in a course of a conversation between a client and a server under a stateless network protocol, such as HTTP. In one embodiment, after the initial request, the client is redirected to the same page as requested, but with a modified URL that includes an ID assigned to the conversation. Because the links of the redirected page are static, no URL rewriting is required. When the client clicks on one of the links of the page, the Referrer field of HTTP carries the conversation ID as part of the modified URL. This process is repeated during the conversation. The second embodiment needs only a single redirect at the beginning of the conversation, but requires that all URLs be relative to the root of the server. Here, we encode the ID in the modified URL at the root, so that all future accesses from the relative links automatically encode the ID in the root of the URL.

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METHOD FOR STATE PRESERVATION IN HTTP-BASED COMMUNICATIONS

TECHNICAL FIELD

This invention relates to computer communication in a client-server environment under a stateless protocol. More specifically, the invention relates to a method for client state preservation when communicating using the HyperText Transfer Protocol.

BACKGROUND OF THE INVENTION

The HyperText Transfer Protocol ("HTTP") is commonly used on the Internet for requesting and sending documents. Typically, a World Wide Web ("WHITING:") client browser connects to a server and requests a document using HTTP. HTTP for WHITING: is of course well know. It's specification is available on line at <ftp://ftp.isi.edu/in-notes/rfc2616.txt> ("HTTP specification"). The specification is hereby incorporated by reference as if fully set forth herein.

HTTP is a stateless protocol. By stateless we mean that a client does not store information regarding a completed information exchange with a server, and therefore does not provide the information to the server during a subsequent request for information. But often it is desirable for the server to have client state information.

For example, it may be desirable to identify the client and to provide client-specific information in response to a request. If the client previously identified him- or herself during a particular session, it would be truly annoying to the client to keep submitting identifying information with each screen. More insidiously, user identification can be used for delivery of targeted advertisement and for updating user profiles through tracking of the sites visited by the user.

It may also be desirable to preserve state information in addition to client ID. Thus, because of intermediate caching, the client may be requesting

documents while viewing a page other than the last page sent to the client by the server, and a response to the client's request may be page-dependent.

Two of the better known state preservation techniques are "cookies" and Uniform Resource Locator ("URL") rewriting. Cookies are subject of U.S. Patent Number 5,774,670 to Montulli, assigned to Netscape Communications Corporation (the "Netscape patent"). URL rewriting is subject of U.S. Patent Number 5,961,601 to Iyengar, assigned to International Business Machines Corporation (the "IBM" patent).

Briefly, according to the method of the Netscape patent, the server sends a small file - a cookie - to the client to be stored locally by the client. The cookie is then sent by the client to the server with subsequent a request. The disclosure of the Netscape patent is hereby incorporated by reference as if fully set forth herein. URL description can be found in <http://www.rfc-editor.org/rfc/rfc1738.txt> ("URL specification"), which document is hereby incorporated as if fully set forth herein.

Using cookies has the disadvantages of requiring user permission for local access; in other words, cookies may be disabled. Another disadvantage of cookies is that they do not appear in the server's log files. And, as noted above, the method has been patented and therefore unavailable or expensive to use.

According to the method of the IBM patent, when the server receives a request for a particular page, it creates a new page containing all the information of the requested page, and redirects the client to the new page. State information is embedded in the hyperlinks in the new page. When the user clicks on a hyperlink, the client's browser automatically transmits information - to the server. For example, if the user visits www.amazon.com, the user will be redirected to a URL similar to this: <http://www.amazon.com/exec/obidos/subst/home.html/102-7545796-2745608>. The trailing number carry state information. Viewing the page's source code reveals that all URLs have been rewritten to contain the state information.

The disclosure of the IBM patent is hereby incorporated by reference as if fully set forth herein, including of course the Glossary; but the term "conversation" as used herein has the following meaning: A sequence of communications between a client and server in which the server sends regular or terminal responses to the client's requests, a regular response includes on or more continuations, a terminal response includes no continuations, the client selects each response from continuations received by the client from the server in the course of the sequence of communications.

The major disadvantage of the method of the IBM patent is that the server must create a brand new page with every request of the client. This takes time and resources, degrading performance. And the method is also patented.

OBJECT OF THE INVENTION

One object of this invention is to provide a new method for preserving client state information during HTTP-based communications. Another object of the invention is to provide a method that is faster than URL rewriting and requires less computational resources.

Yet another object is to create a mechanism for storing state information in server log files, enabling generation of reports on user behavior during a particular session.

SUMMARY OF THE INVENTION

According to the method of this invention, when a client contacts a server, the server redirects the client to the same page with the information encoded in the URL of the redirected page. Every hyperlink of the redirected page will automatically contain the state information identifying the session in the HTTP Referrer header of the request to the server associated with the link.

If all the links of a page are relative to the virtual state root note, i.e., if the links point only to other pages with the same domain name, the redirection can

be performed only once, to a page with assigned state identifier encoded in the URL at the root. After the initial redirection, all requests to the server will carry the state identifier, which should be stripped by a recognized by special servlet on the server before serving the static files requested by the client.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a non-limiting illustration of the "HTTP Referrer" method.

Figure 2 is a non-limiting illustration of the "URL Encoding" method.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

1. HTTP REFERRER

With this approach, the server maintains state information by encoding it in specially created URLs, and examining the standard HTTP Referrer request header fields of all requests from clients to identify the specific URL included in each request's header.

In the Referrer field, the client can specify the address of the resource that supplied the address of the service requested by the client from the server. The HTTP Referrer is described in more detail in section 14.36 of the HTTP specification.

Initially, a user/client first attempts to visit a server's site by sending the server the user's first request for service. In the first request, the Referrer header does not contain any state information, i.e., the header does not contain one of the URLs previously created by the server and recognizable by the server from the state information encoded in them. For this reason, the server treats the request as the beginning of a new conversation, creating a state object to identify the conversation. The server then redirects the client to the same page, but with state information encoded in the page's URL. For example, if the user attempts to view <http://www.softcom.com/index.htm>, the user may be redirected to

<http://www.softcom.com/index.htm?state=3476>. This is a static page whose URL contains state information. By static we mean that none of the information of the original index.htm page, including hyperlinks, has changed. Only the URL has changed.

All links and other embedded content referenced by this page will include an HTTP Referrer header containing the referring URL -

<http://www.softcom.com/index.htm?state=3476>. The state information of the client can be obtained by parsing this URL and then used to construct a new URL that the user is then redirected to. Thus, if the user is viewing <http://www.softcom.com/index.htm?state=3476> that, for example, contains a link such as `< A HREF="foo.htm" >`, and the user clicks on that link, the browser will employ the HTTP GET method on <http://www.softcom.com/foo.htm>, with the HTTP Referrer header set to <http://www.softcom.com/index.htm?state=3476>. The server will then construct a new URL using this state and redirect the browser to, for example, <http://www.softcom.com/foo.htm?state=3476>, maintaining the session's state. Alternatively, the server will construct a new URL with a new, unique state assigned to it, for example 3477, to track both the session and the particular place within the session. Subsequent requests from the client to the server made in the course of the same conversation will be treated similarly: the client's state will be identified from the HTTP Referrer field, and the client will be redirected to the requested page at a URL encoded with state information.

2. URL Encoding

The HTTP Referrer approach described in the preceding subsection requires one HTTP redirect per request. The approach described in this subsection requires one redirect per conversation, but works only if all hyperlinks are relative to the root, i.e., relative to the root path element. (by "root" I mean "base URL"; relative links - URLs - generally are links that reside on the same server; both "base URL" and "relative URL" concepts are discussed in

<http://www.ietf.org/rfc/rfc2396.txt>, which document is hereby incorporated by reference as if fully set forth herein.) With this approach, the state (session ID) is encoded in each URL at the root so that the browser automatically maintains it in the root path element.

Suppose, as before, that the client/user initially goes to <http://www.softcom.com/index.htm>. The server assigns a state of "3476" to the session and redirects the client to <http://www.softcom.com/3476/index.htm>. This is the only redirect taken during the session. Note that the session ID (3476) is now encoded at the root of the URL. If this page contains a link to [foo.htm](#), for example, the browser will request <http://www.softcom.com/3476/foo.htm>, automatically encoding the state information in its request. A special file, a "servlet," runs on the server to strip the state portion encoded in the path and to serve the static files to the client. This approach works only for relative URLs; if the URLs are absolute, then each would have to be rewritten, defeating an important object of the invention.

The HTTP Referrer and the URL Encoding methods described above encode state information within the URLs accessed. The web server log files often record this information in the server's log files. Advantageously, both methods thus allow existing mechanism to record user behavior during a particular session.

The inventive methods are described in this specification in a general manner. Those skilled in the art will be able to devise various modifications that although not explicitly described or shown herein, embody the principles of the invention and are thus within its spirit and scope.

I CLAIM:

1. A method for maintaining state information in a client-server network environment during a conversation between a client and a server operating under a stateless protocol, the method comprising the steps of:

receiving, by the server, a first request of the client for a first service provided by the server, the first request containing no state information, the first request including a first identifier of the first service;
creating a first state object by the server in response to the first request;

generating, by the server, a second identifier of the first service, the second identifier of the first service including the first state object;

instructing the client to request the first service with a second request that includes the second identifier;

receiving the second request by the server;

generating, by the server, a first response to a request for the first service by the client; and

sending the first response to the client.

2. A method according to claim 1, wherein the first response includes a first continuation, the first continuation includes a third identifier of a second service provided by the server, the third identifier of the second service does not contain state information.

3. A method according to claim 2, further including the steps of:

receiving a third request for the second service sent by the client to the server, the third request including the second identifier of the first service, the third request including the third identifier of the second service;

parsing the received third request to identify the first state object in the second identifier of the first service;

generating, by the server, a fourth identifier of the second service, the fourth identifier of the second service including the first state object;

instructing the client to request the second service with a fourth request that includes the fourth identifier;

receiving, by the server, the fourth request, the fourth request including the third identifier of the second service; and

parsing the received fourth request to identify the first state object.

4. A method according to claim 3, wherein:

the stateless protocol is HTTP;

the first identifier of the first service comprises a first URL;

the second identifier of the first service comprises a second URL, the second URL comprises the first state object;

the third identifier of the second service comprises a third URL;

the fourth identifier of the second service comprises a fourth URL, the fourth URL comprises the first state object;

the second request includes the first identifier in an HTTP Referrer field of the second request; and

the third request includes the second identifier in an HTTP Referrer field of the third request;

further including the step of parsing the received second request to identify the first state object in the second identifier.

5. A method according to claim 2, further including the steps of:

receiving the third request by the server;

parsing the received third request to identify the first state object in the second identifier of the first service;

creating a second state object by the server in response to the third request;

generating, by the server, a fourth identifier of the second service, the fourth identifier of the second service including the second state object;

instructing the client to request the second service with a fourth request that includes the fourth identifier;

sending from the client to the server the fourth request that includes the third identifier of the second service;

receiving the fourth request by the server; and

parsing the received fourth request to identify the second state object.

6. A method according to claim 5, wherein:

the stateless protocol is HTTP;

the first identifier of the first service comprises a first URL;

the second identifier of the first service comprises a second URL, the second URL comprises the first state object;

the third identifier of the second service comprises a third URL;

the fourth identifier of the second service comprises a fourth URL, the fourth URL comprises the second state object;

the second request includes the first identifier in HTTP Referrer field of the second request; and

the third request includes the second identifier in HTTP Referrer field of the third request;

further including the step of parsing the received second request to identify the first state object in the second identifier.

7. A method for maintaining state information in a client—server network environment during a conversation between a client and a server operating under a stateless protocol, the method comprising the steps of:

receiving, by the server, a first request of the client for a first service provided by the server, the first request containing no state information, the first request including a first identifier of the first service;
creating a state object by the server in response to the first request;
generating, by the server, a second identifier of the first service, the second identifier of the first service including the first identifier, the second identifier of the first service including the state object encoded at the root of the first identifier;
instructing the client to request the first service with a second request that includes the second identifier;
receiving the second request by the server;
generating, by the server, a first response to a request for the first service by the client; and
sending the first response to the client.

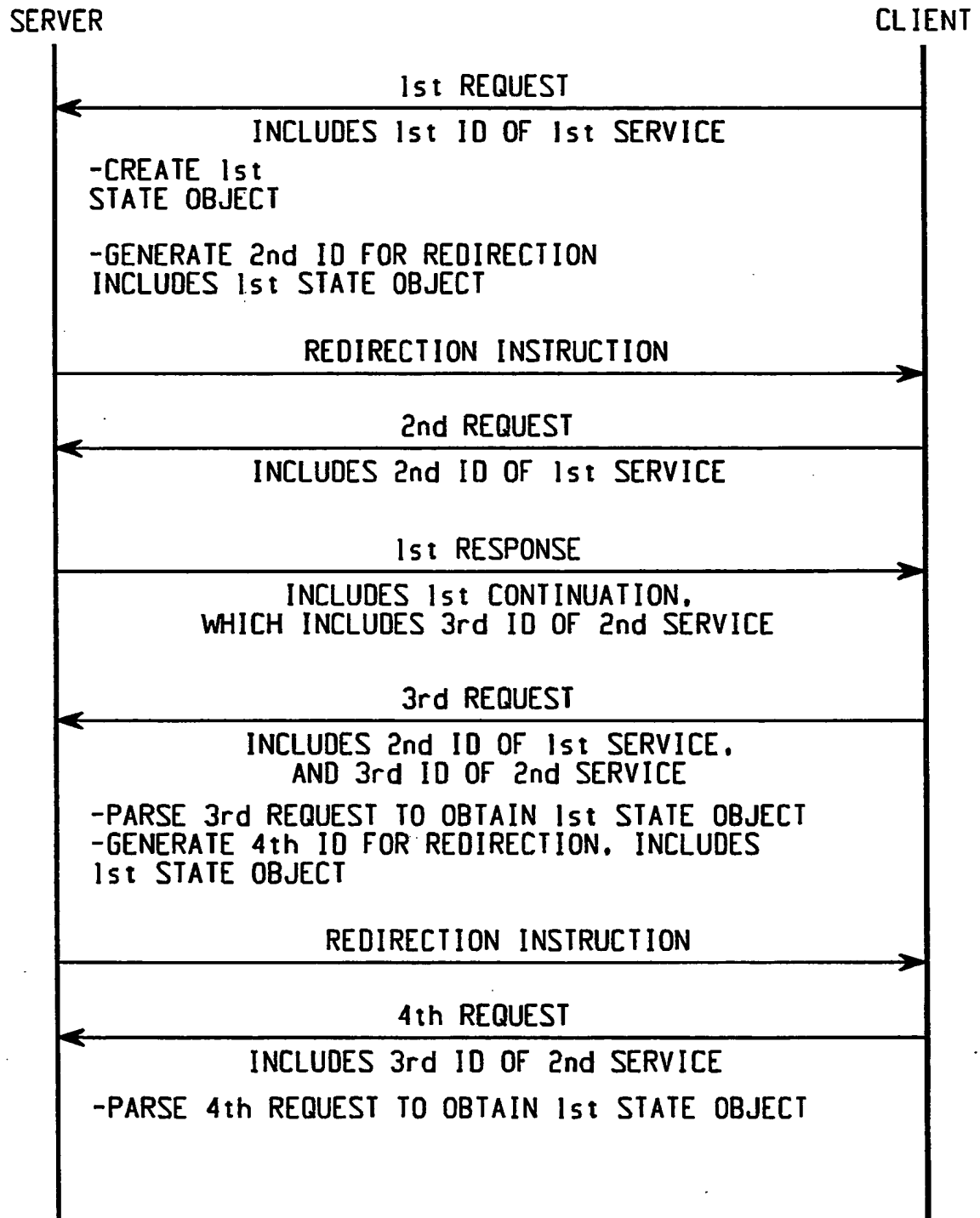
8. A method according to claim 7, wherein the first response includes a first continuation, the first continuation includes a third identifier of a second service provided by the server, the third identifier of the second service does not contain state information, the method further including the steps of:

receiving, by the server, a third request for the second service sent by the client to the server after the client receives the first response, the third request including the root, the state object, and the third identifier of the second service;
parsing the received third request to identify the state object and the second service;

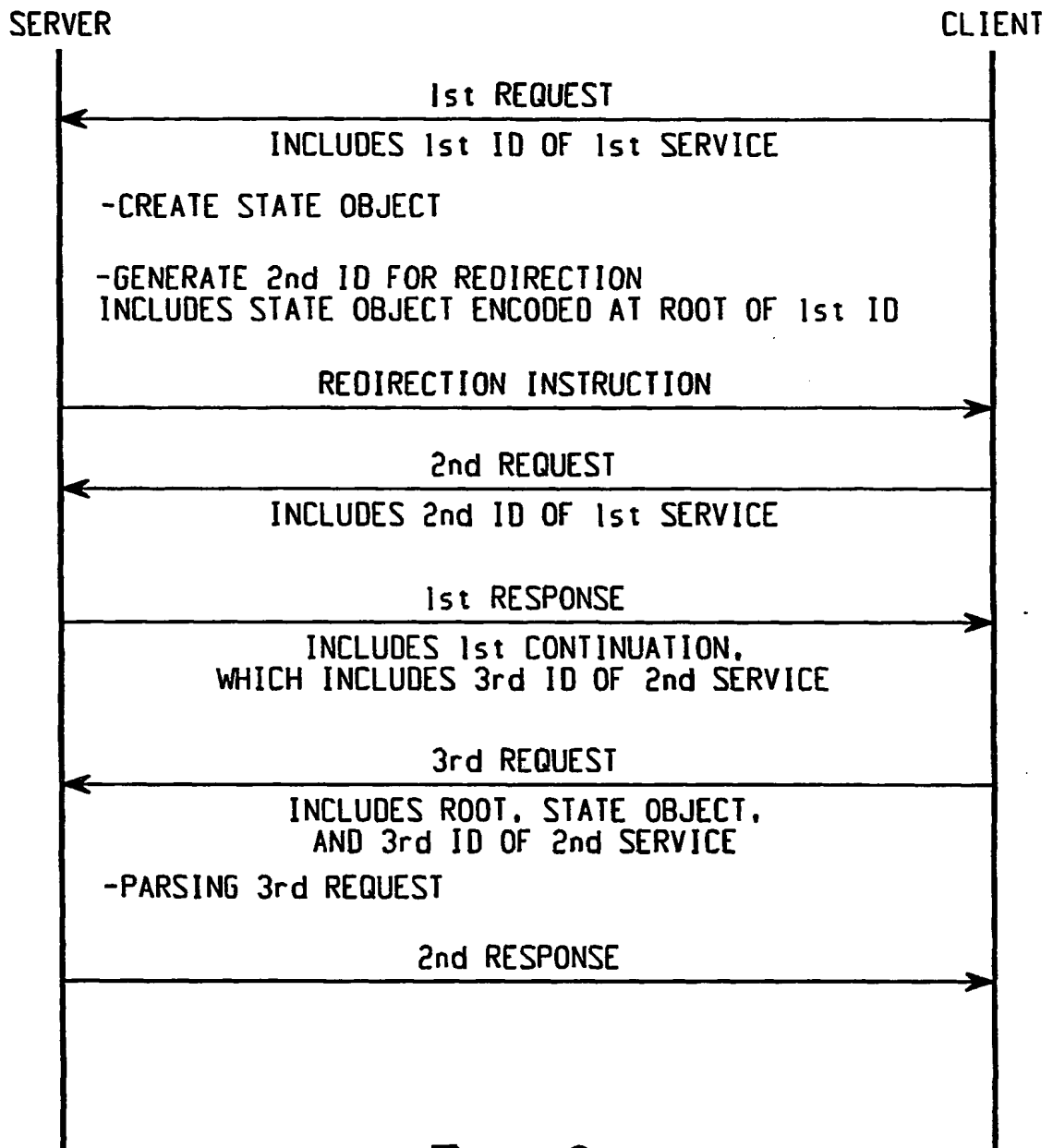
generating, by the server, a second response to the third request for the second service; and
sending the second response to the client.

9. A method according to claim 8, wherein:
- the stateless protocol is HTTP;
 - the first identifier of the first service comprises a first URL;
 - the second identifier of the first service comprises a second URL, the second URL comprises the state object;
 - the third identifier of the second service comprises a third URL, the third URL comprises the state object;
 - further including the step of parsing the received second request to identify the first state object in the second identifier.

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*Fig. 1*

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*Fig. 2*

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GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,
MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK,
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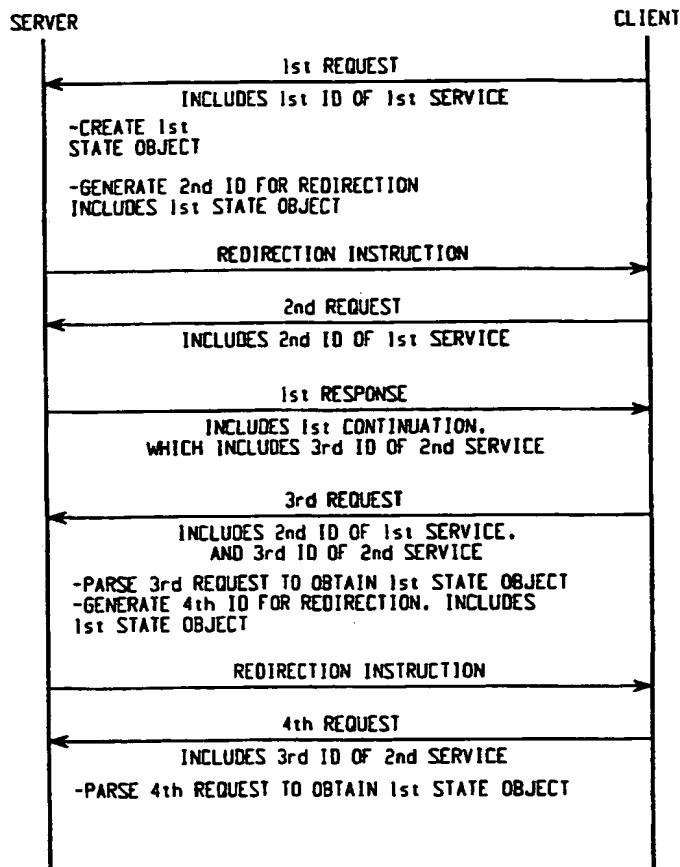
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KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian
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patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,

(72) Inventor; and

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(54) Title: **METHOD FOR STATE PRESERVATION IN HTTP-BASED COMMUNICATIONS**



(57) Abstract: This is a method for monitoring client state in a course of a conversation between a client and a server under a stateless network protocol, such as HTTP. In one embodiment, after the initial request, the client is redirected to the same page as requested, but with a modified URL that includes an ID assigned to the conversation. Because the links of the redirected page are static, no URL rewriting is required. When the client clicks on one of the links of the page, the Referrer field of HTTP carries the conversation ID as part of the modified URL. This process is repeated during the conversation. The second embodiment needs only a single redirect at the beginning of the conversation, but requires that all URLs be relative to the root of the server. Here, we encode the ID in the modified URL at the root, so that all future accesses from the relative links automatically encode the ID in the root of the URL.

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

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